

What is claimed is:

1. An image collation apparatus comprising:
- first collation means for obtaining a coincidence ratio between first and second images within a printing element range for each collation unit by collating the first and second images with each other;
- minimum coincidence ratio extraction means for obtaining a minimum coincidence ratio from coincidence ratios obtained from said first collation means; and
- determination means for determining that the first and second images are identical, if the extracted minimum coincidence ratio is smaller than a predetermined threshold.
2. An apparatus according to claim 1, wherein
- said apparatus further comprises first image transformation means for repeatedly executing at least one of translation processing and rotation processing for the first image within a predetermined range for each collation unit and outputting the first image after the image processing, and
- said first collation means obtains the coincidence ratio by collating the first image output from said first image transformation means with the second image every time said first image transformation means performs image processing.

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3. An apparatus according to claim 1, wherein
2 said apparatus further comprises
3 maximum coincidence ratio extraction means for
4 obtaining a maximum coincidence ratio from coincidence
5 ratios output from said first collation means, and
6 computation means for obtaining a difference
7 between the maximum coincidence ratio output from said
8 maximum coincidence ratio extraction means and the
9 minimum coincidence ratio output from said minimum
10 coincidence ratio extraction means, and
11 said determination means comprises
12 determination means for determining that the first and
13 second images are identical, if the difference output
14 from said computation means is not less than a
15 predetermined threshold.

4. An apparatus according to claim 1, wherein
2 said apparatus further comprises
3 maximum coincidence ratio extraction means for
4 obtaining a maximum coincidence ratio from coincidence
5 ratios output from said first collation means, and
6 computation means for obtaining a quotient by
7 dividing the maximum coincidence ratio output from said
8 maximum coincidence ratio extraction means by the
9 minimum coincidence ratio output from said minimum
10 coincidence ratio extraction means, and

11 said determination means determines that the
12 first and second images are identical, if the quotient
13 output from said computation means is not less than a
14 predetermined threshold.

5. An apparatus according to claim 1, wherein
2 said apparatus further comprises maximum
3 coincidence ratio extraction means for obtaining a
4 maximum coincidence ratio from coincidence ratios output
5 from said first collation means, and
6 said determination means determines that the
7 first and second images are identical, if the maximum
8 coincidence ratio output from said maximum coincidence
9 ratio extraction means is not less than a first
10 predetermined threshold and the minimum coincidence
11 ratio output from said minimum coincidence ratio
12 extraction means is smaller than a second predetermined
13 threshold (first threshold \geq second threshold).

6. An apparatus according to claim 2, wherein
2 said apparatus further comprises
3 second image transformation means for
4 repeatedly executing at least one image processing of
5 translation processing and rotation processing for the
6 first image located at a first initial position by a
7 predetermined amount within a predetermined range, and
8 outputting the first image after image processing,

9 second collation means for obtaining a
10 coincidence ratio by collating the first image output
11 from said second image transformation means with the
12 second image every time said second image transformation
13 means performs image processing, and
14 storage means for storing a translation amount,
15 rotational angle, or both a translation amount and
16 rotational angle of the first image from the first
17 information position to a current position when the
18 coincidence ratio output from said second collation
19 means becomes maximum, and
20 said first image transformation means moves
21 the first image to a second initial position set by
22 adding the translation, rotational angle, or translation
23 amount and rotational angle stored in said storage means
24 to the first initial position, and executes at least one
25 of translation processing and rotation processing for
26 the first image.

7. An apparatus according to claim 6, wherein the
2 range predetermined for said first image transformation
3 means is narrower than the range predetermined for said
4 second image transformation means.

8. An apparatus according to claim 6, wherein a
2 collation region in which said second collation means
3 obtains the coincidence ratio is smaller than a

4 collation region in which said first collation means
5 obtains the coincidence ratio.

9. An apparatus according to claim 6, wherein
2 the translation amount, rotational angle, or translation
3 amount and rotational angle by which said second image
4 transformation means moves the first image for each
5 moving operation are larger than the translation amount,
6 rotational angle, or translation amount and rotational
7 angle by which said first image transformation means
8 moves the first image for each moving operation.

10. An apparatus according to claim 2, wherein
2 said apparatus further comprises
3 reference point detection means for detecting
4 reference points of the first and second images located
5 at the first initial position, and
6 correction amount computation means for
7 obtaining a translation amount, rotational angle, or
8 both translation amount and rotational angle of the
9 first image which is required to make the reference
10 points of the first and second image coincide with each
11 other, and
12 said first image transformation means moves
13 the first image to a second initial position set by
14 adding the translation amount, rotational angle, or
15 translation amount and rotational angle obtained by said

16 correction amount computation means to the first initial
17 position, and executes at least one of translation
18 processing and rotation processing for the first image.

11. An apparatus according to claim 6, wherein
2 said apparatus further comprises
3 reference point detection means for detecting
4 reference points of the first and second images located
5 at the first initial position, and
6 correction amount computation means for
7 obtaining a translation amount, rotational angle, or
8 both translation amount and rotational angle of the
9 first image which is required to make the reference
10 points of the first and second image coincide with each
11 other, and
12 said second image transformation means moves
13 the first image to a new first initial position set by
14 adding the translation amount, rotational angle, or
15 translation amount and rotational angle obtained by said
16 correction amount computation means to the first initial
17 position, and executes at least one of translation
18 processing and rotation processing for the first image.

12. An apparatus according to claim 1, wherein
2 said apparatus further comprises region
3 designation means for sequentially designating a
4 plurality of collation regions predetermined as regions

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5 in which the first and second images are collated with
6 each other, and
7 said first collation means obtains coincidence
8 ratios by sequentially collating the first and second
9 images with each other in the collation regions
10 designated by said region designation means.

13. An apparatus according to claim 12, wherein
2 said apparatus further comprises computation
3 means for averaging minimum coincidence ratios
4 corresponding to the respective collation regions output
5 from said minimum coincidence ratio extraction means,
6 and
7 said determination means determines that the
8 first and second images are identical, if the minimum
9 coincidence ratio average output from said computation
10 means is smaller than a predetermined threshold.

14. An apparatus according to claim 2, wherein
2 said apparatus further comprises region
3 designation means for sequentially designating a
4 plurality of collation regions predetermined as regions
5 in which the first and second images are collated with
6 each other, and
7 said first collation means sequentially
8 obtains a coincidence ratio by collating the first image
9 output from said image transformation means with the

10 second image in each collation region designated by said
11 region designation means every time said first image
12 transformation means performs image processing.

15. An apparatus according to claim 14, wherein
2 said apparatus further comprises computation
3 means for averaging minimum coincidence ratios
4 corresponding to the respective collation regions output
5 from said minimum coincidence ratio extraction means,
6 and
7 said determination means determines that the
8 first and second images are identical, if the minimum
9 coincidence ratio average output from said computation
10 means is smaller than a predetermined threshold.

16. An apparatus according to claim 14, wherein
2 said apparatus further comprises selection
3 means for comparing minimum coincidence ratios
4 corresponding to the respective collation regions which
5 are output from said minimum coincidence ratio
6 extraction means and sequentially outputting only a
7 predetermined number of minimum coincidence ratios in
8 increasing order, and
9 said computation means averages the minimum
10 coincidence ratios output from said selection means.

17. An apparatus according to claim 1, wherein

2 said apparatus further comprises image
3 processing means for selecting one of contraction and
4 expansion for one of the first and second images and
5 performing a plurality of different image processes, and
6 said collation means collates an output from
7 said image processing means with an image having
8 undergone no image processing.

18. An apparatus according to claim 2, wherein
2 said apparatus further comprises image
3 processing means for selecting one of contraction and
4 expansion for one of the first and second images and
5 performing a plurality of different image processes, and
6 said collation means collates an output from
7 said image processing means with an image having
8 undergone no image processing.

19. An apparatus according to claim 18, wherein
2 said image processing means performs the plurality of
3 different image processes by repeatedly executing image
4 processing for the selected image for every
5 predetermined amount.

20. An apparatus according to claim 18, wherein
2 said image processing means comprises
3 thinning means for decreasing a line width of
4 an input image to a value corresponding to about one

5 pixel, and

6 expansion means for fattening the image output
7 from said thinning means, and

8 increases the line width corresponding to
9 about one pixel to a predetermined width, and outputs
10 the image.

21. An apparatus according to claim 18, further
2 comprising storage means for storing an image output
3 from said image processing means and outputting the
4 image to said collation means.

22. An apparatus according to claim 2, wherein
2 said apparatus further comprises
3 second image transformation means for
4 repeatedly executing at least one of translation
5 processing (shifting) and rotation processing for the
6 first image located at the first initial position within
7 a predetermined range for every predetermined amount,
8 and outputting a first image after the processing,
9 second collation means for obtaining a
10 coincidence ratio by comparing/collating the first image
11 output from said second transformation means with the
12 second image every time said second image transformation
13 means performs processing, and
14 storage means for storing a translation amount,
15 rotational angle, or translation amount and rotational

16 angle of the first image from the first initial position
17 to a current position when the coincidence ratio output
18 from said second collation means becomes maximum, and
19 said first image transformation means moves
20 the first image to a second initial position set by
21 adding the translation amount, rotational angle, or
22 translation amount and rotational angle stored in said
23 storage means to the first initial position, and
24 executes at least one of translation processing and
25 rotation processing for the resultant first image.

23. An apparatus according to claim 22, wherein
2 said apparatus further comprises image
3 processing means for selecting one of contraction and
4 expansion for the second image and performing a
5 plurality of different image processes, and
6 said storage means for storing the second
7 image output from said image processing means, and
8 said second collation means obtains a
9 coincidence ratio by comparing/collating the first image
10 output from said second image transformation means with
11 the second image output from said storage means every
12 time said second image transformation means performs
13 processing.

24. An apparatus according to claim 22, wherein
2 the range predetermined for said first image

3 transformation means is narrower than the range
4 predetermined for said second image transformation means.

25. An apparatus according to claim 22, wherein
2 the translation amount, rotational angle, or translation
3 amount and rotational angle by which said second image
4 transformation means moves the first image for each
5 moving operation are larger than the translation amount,
6 rotational angle, or translation amount and rotational
7 angle by which said first image transformation means
8 moves the first image for each moving operation.

26. An apparatus according to claim 22, wherein a
2 collation region in which the coincidence ratio is
3 obtained by said second collation means is smaller than
4 a collation region in which a coincidence ratio is
5 obtained by said first collation means.

27. An apparatus according to claim 3, wherein
2 said apparatus further comprises region
3 designation means for sequentially designating a
4 plurality of collation regions predetermined as regions
5 in which the first and second images are collated with
6 each other, and
7 said first collation means obtains coincidence
8 ratios by sequentially collating the first image output
9 from said image transformation means with the second

10 image within a collation region designated by said
11 region designation means every time said first image
12 transformation means performs image processing.

28. An apparatus according to claim 27, wherein
2 said apparatus further comprises image
3 processing means for selecting one of contraction and
4 expansion for one of the first and second images and
5 performing a plurality of different image processes, and
6 said first collation means collates an output
7 from said image processing means with an image having
8 undergone no image processing.

29. An image collation apparatus comprising:
2 first collation means for obtaining a
3 relationship between first and second images for each
4 collation unit by collating the first and second images
5 with each other;
6 minimum coincidence ratio extraction means for
7 obtaining a minimum coincidence ratio from coincidence
8 ratios in the relationship obtained from said first
9 collation means;
10 determination means for determining that the
11 first and second images are identical, if the extracted
12 coincidence ratio is smaller than a predetermined
13 threshold; and
14 region designation means for sequentially

15 designating a plurality of collation regions
16 predetermined as regions in which the first and second
17 images are collated with each other,
18 wherein said first collation means obtains
19 coincidence ratios by sequentially collating the first
20 and second images within the collation regions
21 designated by said region designation means.

30. An apparatus according to claim 29, wherein
2 said apparatus further comprises image
3 processing means for selecting one of contraction and
4 expansion for one of the first and second images and
5 performing a plurality of different image processes, and
6 said first collation means collates an output
7 from said image processing means with an image having
8 undergone no image processing.

31. An image collation method comprising:
2 the first collation step of obtaining a
3 coincidence ratio in a predetermined range between first
4 and second images in each collation unit by collating
5 the first and second images with each other;
6 the minimum coincidence ratio extraction step
7 of obtaining a minimum coincidence ratio from
8 coincidence ratios obtained in the first collation step;
9 and
10 the determination step of determining that the

11 first and second images are identical, if the extracted
12 minimum coincidence ratio is smaller than a
13 predetermined threshold.

32. A method according to claim 31, wherein
2 the method further comprises the first image
3 transformation step of repeatedly executing at least one
4 of translation processing and rotation processing for
5 the first image within a predetermined range for each
6 collation unit, and
7 in the first collation step, a coincidence
8 ratio is obtained by collating the obtained first image
9 after image processing with the second image.

33. A method according to claim 32, wherein
2 the method further comprises
3 the maximum coincidence ratio extraction step
4 of obtaining a maximum coincidence ratio from
5 coincidence ratios output in the first collation step,
6 and
7 the computation step of obtaining a difference
8 between the maximum coincidence ratio and the minimum
9 coincidence ratio, and
10 in the determination step, it is determined
11 that the first and second images are identical, if the
12 difference is not less than a predetermined threshold.

34. A method according to claim 32, wherein

2 the method further comprises

3 the maximum coincidence ratio extraction step

4 of obtaining a maximum coincidence ratio from

5 coincidence ratios obtained in the first collation step,

6 and

7 the computation step of obtaining a quotient

8 by dividing the maximum coincidence ratio by the minimum

9 coincidence ratio, and

10 in the determination step, it is determined

11 that that the first and second images are identical, if

12 the quotient is not less than a predetermined threshold.

35. A method according to claim 32, wherein

2 the method further comprises the maximum

3 coincidence ratio extraction step of obtaining a maximum

4 coincidence ratio from coincidence ratios obtained in

5 the first collation step, and

6 in the determination step, it is determined

7 that the first and second images are identical, if the

8 maximum coincidence ratio is not less than a first

9 predetermined threshold and the minimum coincidence

10 ratio is smaller than a second predetermined threshold

11 (first threshold \geq second threshold).

36. A method according to claim 32, wherein

2 the method further comprises

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3 the second image transformation step of
4 repeatedly executing at least one image processing of
5 translation processing and rotation processing for the
6 first image located at a first initial position by a
7 predetermined amount within a predetermined range, and
8 obtaining the first image after image processing,
9 the second collation step of obtaining a
10 coincidence ratio by collating the first image after the
11 image processing with the second image every time image
12 processing is performed for the first image, and
13 the storage step of storing a translation
14 amount, rotational angle, or both a translation amount
15 and rotational angle of the first image from the first
16 information position to a current position when the
17 coincidence ratio becomes maximum, and
18 in the first image transformation step, the
19 first image is moved to a second initial position set by
20 adding the translation, rotational angle, or translation
21 amount and rotational angle stored in the storage step
22 to the first initial position, and at least one of
23 translation processing and rotation processing is
24 executed for the first image.

37. A method according to claim 36, wherein the
2 range predetermined in the first image transformation
3 step is narrower than the range predetermined in the
4 second image transformation step.

40. A method according to claim 32, wherein the method further comprises the reference point detection step of detecting reference points of the first and second images located at the first initial position before the respective steps, and the correction amount computation step of obtaining a translation amount, rotational angle, or both translation amount and rotational angle of the first image which is required to make the reference points of the first and second image coincide with each

12 other, and
13 the first image transformation step comprises
14 the step of moving the first image to a second initial
15 position set by adding the translation amount,
16 rotational angle, or translation amount and rotational
17 angle obtained in the correction amount computation step
18 to the first initial position, and executing at least
19 one of translation processing and rotation processing
20 for the first image.

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41. A method according to claim 36, wherein
2 the method further comprises
3 the reference point detection step of
4 detecting reference points of the first and second
5 images located at the first initial position before the
6 respective steps, and
7 the correction amount computation step of
8 obtaining a translation amount, rotational angle, or
9 both translation amount and rotational angle of the
10 first image which is required to make the reference
11 points of the first and second image coincide with each
12 other, and
13 the second image transformation step comprises
14 the step of moving the first image to a new first
15 initial position set by adding the translation amount,
16 rotational angle, or translation amount and rotational
17 angle obtained in the correction computation step to the

18 first initial position, and executing at least one of
19 translation processing and rotation processing for the
20 first image.

42. A method according to claim 33, wherein
2 the method further comprises the region
3 designation step of sequentially designating a plurality
4 of collation regions predetermined as regions in which
5 the first and second images are collated with each other,
6 and
7 coincidence ratios are obtained by
8 sequentially collating the first and second images with
9 each other in the collation regions.

43. A method according to claim 42, wherein
2 the method further comprises the image
3 processing step of selecting one of contraction and
4 expansion for one of the first and second images and
5 performing a plurality of different image processes, and
6 the first and second images are collated with
7 each other by collating the image having undergone the
8 image processing with an image having undergone no image
9 processing.

44. An image collation method comprising:
2 the first collation step of obtaining a
3 relationship between first and second images for each

4 collation unit by collating the first and second images
5 with each other;
6 the minimum coincidence ratio extraction step
7 of obtaining a minimum coincidence ratio from
8 coincidence ratios in the relationship obtained in the
9 first collation step;
10 the determination step of determining that the
11 first and second images are identical, if the extracted
12 coincidence ratio is smaller than a predetermined
13 threshold; and
14 the region designation step of sequentially
15 designating a plurality of collation regions
16 predetermined as regions in which the first and second
17 images are collated with each other,
18 wherein coincidence ratios are obtained by
19 sequentially collating the first and second images
20 within the collation regions.

45. A method according to claim 44, wherein
2 the method further comprises the image
3 processing step of selecting one of contraction and
4 expansion for one of the first and second images and
5 performing a plurality of different image processes, and
6 the first and second images are collated with
7 each other by collating the image having undergone the
8 image processing with an image having undergone no image
9 processing.

46. A recording medium storing an image collation

program for causing a computer to execute

the first collation step of obtaining a
coincidence ratio in a predetermined range between first
and second images in each collation unit by collating
the first and second images with each other,

the minimum coincidence ratio extraction step
of obtaining a minimum coincidence ratio from
coincidence ratios obtained in the first collation step,
and

the determination step of determining that the
first and second images are identical, if the extracted
minimum coincidence ratio is smaller than a
predetermined threshold.

47. A medium according to claim 46, wherein

the program further comprises the first image
transformation step of repeatedly executing at least one
of translation processing and rotation processing for
the first image within a predetermined range for each
collation unit, and

in the first collation step, a coincidence
ratio is obtained by collating the obtained first image
after image processing with the second image.

48. A medium according to claim 46, wherein

2 the program further comprises
3 the maximum coincidence ratio extraction step
4 of obtaining a maximum coincidence ratio from
5 coincidence ratios output in the first collation step,
6 and
7 the computation step of obtaining a difference
8 between the maximum coincidence ratio and the minimum
9 coincidence ratio, and
10 in the determination step, it is determined
11 that the first and second images are identical, if the
12 difference is not less than a predetermined threshold.

49. A medium according to claim 46, wherein

2 the program further comprises
3 the maximum coincidence ratio extraction step
4 of obtaining a maximum coincidence ratio from
5 coincidence ratios obtained in the first collation step,
6 and
7 the computation step of obtaining a quotient
8 by dividing the maximum coincidence ratio by the minimum
9 coincidence ratio, and
10 in the determination step, it is determined
11 that that the first and second images are identical, if
12 the quotient is not less than a predetermined threshold.

50. A medium according to claim 46, wherein

2 the program further comprises the maximum

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3 coincidence ratio extraction step of obtaining a maximum
4 coincidence ratio from coincidence ratios obtained in
5 the first collation step, and
6 in the determination step, it is determined
7 that the first and second images are identical, if the
8 maximum coincidence ratio is not less than a first
9 predetermined threshold and the minimum coincidence
10 ratio is smaller than a second predetermined threshold
11 (first threshold \geq second threshold).

51. A medium according to claim 46, wherein
2 the program further comprises
3 the second image transformation step of
4 repeatedly executing at least one image processing of
5 translation processing and rotation processing for the
6 first image located at a first initial position by a
7 predetermined amount within a predetermined range, and
8 obtaining the first image after image processing,
9 the second collation step of obtaining a
10 coincidence ratio by collating the first image after the
11 image processing with the second image every time image
12 processing is performed for the first image, and
13 the storage step of storing a translation
14 amount, rotational angle, or both a translation amount
15 and rotational angle of the first image from the first
16 information position to a current position when the
17 coincidence ratio becomes maximum, and

18 in the first image transformation step, the
19 first image is moved to a second initial position set by
20 adding the translation, rotational angle, or translation
21 amount and rotational angle stored in the storage step
22 to the first initial position, and at least one of
23 translation processing and rotation processing is
24 executed for the first image.

52. A medium according to claim 51, wherein the
2 range predetermined in the first image transformation
3 step is narrower than the range predetermined in the
4 second image transformation step.

53. A medium according to claim 51, wherein a
2 collation region in which the coincidence ratio is
3 obtained in the second collation step is smaller than a
4 collation region in which the coincidence ratio is
5 obtained in the first collation step.

54. A medium according to claim 51, wherein the translation amount, rotational angle, or translation amount and rotational angle by the first image is moved in the second image transformation step for each moving operation are larger than the translation amount, rotational angle, or translation amount and rotational angle by which the first image is moved in the first image transformation step for each moving operation.

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55. A medium according to claim 46, wherein
the program further comprises
the reference point detection step of
detecting reference points of the first and second
images located at the first initial position before the
respective steps, and
the correction amount computation step of
obtaining a translation amount, rotational angle, or
both translation amount and rotational angle of the
first image which is required to make the reference
points of the first and second image coincide with each
other, and
the first image transformation step comprises
the step of moving the first image to a second initial
position set by adding the translation amount,
rotational angle, or translation amount and rotational
angle obtained in the correction amount computation step
to the first initial position, and executing at least
one of translation processing and rotation processing
for the first image.

56. A medium according to claim 46, wherein
the program further comprises
the reference point detection step of
detecting reference points of the first and second
images located at the first initial position before the

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6 respective steps, and

7 the correction amount computation step of

8 obtaining a translation amount, rotational angle, or

9 both translation amount and rotational angle of the

10 first image which is required to make the reference

11 points of the first and second image coincide with each

12 other, and

13 the second image transformation step comprises

14 the step of moving the first image to a new first

15 initial position set by adding the translation amount,

16 rotational angle, or translation amount and rotational

17 angle obtained in the correction computation step to the

18 first initial position, and executing at least one of

19 translation processing and rotation processing for the

20 first image.

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